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EXAMINER	
WEBB, GREGORY E	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/662,450	Applicant(s) HIRAOKA ET AL.	
	Examiner Gregory E. Webb	Art Unit 1751	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 April 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1-14 are rejected under 35 U.S.C. 102(e) as being anticipated by Snyder (US6554467).

Concerning the preparation tank, Snyder teaches the following:

As the slurry solution is drawn off, the amount of slurry in the day tank decreases below the low level sensor, at which point the blender/mix tank 102 is activated by the controller to begin forming and supplying a new

slurry solution batch. At this juncture, the programmable logic controller activates the mixing tank to begin adding the components supplied to process/day tank 118, as described above.(col 6., lines 30-36)

Concerning the pump and the slurry, Snyder teaches the following:

In a preferred embodiment, an oxide abrasive slurry material is supplied from a drum 168 through conduits 128 and 130 and is transported through the system by slurry pump 126. When not being introduced into the blending tank 102, the slurry is recirculated to drum 168 via conduits 128, 130 and 132 to maintain the material in a suspended state. While recirculating the slurry material, slurry inlet valve V.sub.1 is closed and recirculation valve V.sub.2 is opened. It will be readily recognized by those skilled in the art that valves V.sub.1 and V.sub.2, as well as the other valves and control devices in the system, automatically operated by a suitable control system.(see col. 3, lines 25-35)

Concerning the concentration detector, ultrasonic concentration detector and the oxidizing agent, Snyder teaches the following:

In the preferred embodiment, the concentration of hydrogen peroxide in the oxide abrasive slurry formulation is measured by a concentration sensor 148. Suitable concentration sensors include, for example, electrodeless conductivity sensors employing AC Torroid coils for ionic solutions, such as those containing hydrogen peroxide, and acoustic signature sensors for non-ionic solutions.(see col. 5, lines 46-53)

Concerning the controller, Snyder teaches the following:

> Blending tank 102 is disposed on a scale 134, which allows measurement of the contents of the blending tank, and thus the weight of each incoming component. A suitable controller such as a programmable logic controller (PLC), a microprocessor type or other known controller (not shown) adjusts and controls the amount of each material provided.(see col. 3, lines 43-48)

Claims 1-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Kawashima (US6338671).

Concerning the preparation tank, Kawashima teaches the following:

> As shown in FIG. 2, the particle size distribution measuring device 52 and the coarse particle measuring device 54 are connected to the supply pipe 36 through the sampling pipes 62a, respectively. Each of the sampling pipes 62a has a sampling valve 64a, a flow rate regulator 66a, a line-mixer 68, and a particle size sensor 70 in sequence. A diluting liquid pipe 76 extending from a diluting liquid supply source 72 is connected to the sampling pipe 62a through a diluting valve 74 and a flow rate regulator 66b at a location between the flow rate regulator 66a and the line-mixer 68.(see col. 5, lines 15-25)

Concerning the pump, Kawashima teaches the following:

> The circulation pipe 112 has a circulation pump 116 for constantly circulating a given flow rate of the polishing liquid, and a back pressure

regulating valve 118 and a pressure sensor 120 for maintaining the internal pressure of the pipe at a constant value or higher. Each of the polishing liquid supply pipes 114 has a polishing liquid supply valve 122 and a pump 124 for withdrawing the polishing liquid individually from the circulation pipe 112.(see col. 8, lines 60-68)

Concerning the concentration detector and the ultrasonic concentration detector, Kawashima teaches the following:

In this example, the solid material concentration measuring device 58 utilizes ultrasonic waves, and comprises an ultrasonic transducer 90 and a reflection surface 92 housed in a casing 88 connected to the supply pipe 36 as shown in FIG. 4. The ultrasonic transducer 90 and the reflection surface 92 are confronted with each other and disposed at a right angle to the flow direction of the polishing liquid. In this arrangement, ultrasonic waves are applied from the ultrasonic transducer 90 to the reflection surface 92, and the propagation velocity of ultrasonic waves in the polishing liquid is measured, thereby measuring concentration of the polishing liquid. A temperature sensor is provided in the casing to correct any effect caused by temperature variations.(see col. 6, lines 1-14)

Concerning the controller, Kawashima teaches the following:

16. The apparatus according to claim 13, further comprising a controller for controlling said polishing apparatus so as not to commence a new polishing operation when measurements of the polishing liquid exceed

predetermined limits.(see claim 16)

Concerning the oxidizing agent, Kawashima teaches the following:

As shown in FIG. 3, the oxidation-reduction electrometer 56 has the sampling pipe 62b connected to the supply pipe 36. In the sampling pipe 62b, there are provided a sampling valve 64b and a measuring vessel 80 having a sensor electrode 78 in sequence, and the measuring vessel 80 is connected to the discharge line 38. A chemical supply source 82 is connected to the measuring vessel 80 through a chemical delivery pipe 86 having a metering pump 84. In this arrangement, a small amount of chemicals such as hydrogen peroxide or potassium permanganate is added to the polishing liquid introduced into the measuring vessel 80, and oxidation-reduction potential of the liquid may be measured by the electrode 78.(see col. 5, lines 55-67)

Claims 1-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Snyder, David L. (US20020085447).

Concerning the preparation tank, Snyder, David L. teaches the following:

[0049] As the slurry solution is drawn off, the amount of slurry in the day tank decreases below the low level sensor, at which point the blender/mix tank 102 is activated by the controller to begin forming and supplying a new slurry solution batch. At this juncture, the programmable

logic controller activates the mixing tank to begin adding the components supplied to process/day tank 118, as described above.

Concerning the pump and the slurry, Snyder, David L. teaches the following:

[0026] In a preferred embodiment, an oxide abrasive slurry material is supplied from a drum 168 through conduits 128 and 130 and is transported through the system by slurry pump 126. When not being introduced into the blending tank 102, the slurry is recirculated to drum 168 via conduits 128, 130 and 132 to maintain the material in a suspended state. While recirculating the slurry material, slurry inlet valve V.sub.1 is closed and recirculation valve V.sub.2 is opened. It will be readily recognized by those skilled in the art that valves V.sub.1 and V.sub.2, as well as the other valves and control devices in the system, automatically operated by a suitable control system.

Concerning the concentration detector, ultrasonic concentration detector and the oxidizing agent, Snyder, David L. teaches the following:

[0042] In the preferred embodiment, the concentration of hydrogen peroxide in the oxide abrasive slurry formulation is measured by a concentration sensor 148. Suitable concentration sensors include, for example, electrodeless conductivity sensors employing AC Torroid coils for ionic solutions, such as those containing hydrogen peroxide, and acoustic signature sensors for non-ionic solutions.

Concerning the controller, Snyder, David L. teaches the following:

[0028] Blending tank 102 is disposed on a scale 134, which allows measurement of the contents of the blending tank, and thus the weight of each incoming component. A suitable controller such as a programmable logic controller (PLC), a microprocessor type or other known controller (not shown) adjusts and controls the amount of each material provided.

Claims 1-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Lai (US6721628).

Concerning the preparation tank, Lai teaches the following:

first mixing means for mixing a first feed, wherein said first feed flows into said first mixing means to form a first mixed fluid, and said first feed comprises an oxidant;(see claim 6)

Concerning the concentration detector, Lai teaches the following:

a concentration detector having an output end and an input end, which is used to measure said first concentration of said oxidant in said mixed fluid, herein said mixed fluid flows toward said input end of said concentration detector from said mixing means;(see claim 7)

Concerning the controller, Lai teaches the following:

4. The method according to claim 2, wherein said liquid level data which is received by said program logic controller (PLC) means is transmitted to program logic controller (PLC) means from said mixing means.(see claim 4)

Concerning the ultrasonic concentration detector and the slurry, Lai teaches the following:

The polishing slurry in the distribution tank 260 flow into a closed loop concentration control system 400 through a third transportable piping 330 wherein the closed loop control system 400 comprises a ultrasonic concentration detector 270, an analog valve 300, a program logic controller (PLC) 290 and a piping controller 280. The polishing slurry first flows into the ultrasonic concentration detector 270 to determine the concentration through the use of instrument. Then, the piping controller 280 controls the polishing slurry to flow into the distribution tank 260 from the ultrasonic concentration detector 270 through a fourth transportable piping 340.(see col. 4, lines 25-37)

Concerning the oxidizing agent, Lai teaches the following:

14. The system according to claim 13, wherein said oxidant comprises a hydrogen peroxide solution.(see claim 14)

Claims 1-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Kawashima, Kiyotaka (US20010002361).

Concerning the pump, Kawashima, Kiyotaka teaches the following:

[0036] An additive supply pipe 220 is connected to the bottom of the concentration adjustment tank 203. The additive supply pipe 220 serves to deliver the additive to a polishing liquid supply system with an additive supply pump 219. The additive supply pump 219 may comprise a diaphragm

pump, a plunger pump, a tubing pump, or the like for supplying the additive at a controlled constant rate. It is desirable that the additive supply pump 219 comprises a plunger pump for supplying the additive at a highly stable rate. The polishing liquid supply system refers to a system downstream of the loop which comprises the supply tank 18, the supply pump 34, and the supply pipe 36.

Concerning the concentration detector and the ultrasonic concentration detector, Kawashima, Kiyotaka teaches the following:

[0038] The polishing liquid pipe 46 has a flow rate sensor 303 and a concentration sensor 305 and the additive supply pipe 222 has a flow rate sensor 304 for confirming whether the polishing liquid supply system is supplied with a predetermined quantity of the additive. Although the additive supply pipe 222 may have an additive concentration sensor, since it is usually difficult to measure an additive concentration from the additive alone, the typical property of the polishing liquid is detected by the concentration sensor 305 after the additive is added to the polishing liquid. The concentration sensor 305 comprises an ultrasonic concentration sensor, for example, and each of the flow rate sensors 303, 304 comprises an ultrasonic flow rate sensor, for example.

Concerning the controller, Kawashima, Kiyotaka teaches the following:

[0017] The polishing liquid supply apparatus may further comprise a sensor associated with the polishing liquid pipe for detecting the concentration

of the additive, and a controller for controlling the additive concentration adjusting device in response to an output signal from the sensor. Further, the polishing liquid supply apparatus may further comprise a sensor associated with the polishing liquid pipe for detecting the concentration of the additive, and a controller for controlling the additive quantity adjusting device in response to an output signal from the sensor.

Concerning the oxidizing agent, Kawashima, Kiyotaka teaches the following:

[0010] The polishing liquid contains an additive such as an oxidizing agent for modifying or reforming the polished surface of the semiconductor wafer. Specifically, an oxidizing agent such as H.sub.2O.sub.2 (hydrogen peroxide) is added for the purpose of oxidizing a metal film of copper or tungsten that has been deposited on the semiconductor wafer. It has been customary to add the additive when the polishing liquid is produced. Thus, in the case where the additive, like oxidizing agent, added to the polishing liquid is chemically unstable, the properties of the polishing liquid tend to be changed when the polishing liquid with the additive is held in stock for a long period of time, with the result that the polishing capability of the polishing liquid becomes unstable.

Concerning the slurry, Kawashima, Kiyotaka teaches the following:

A polishing liquid supply apparatus supplies a polishing liquid to a

polishing unit. The polishing liquid supply apparatus includes a supply tank for storing a polishing liquid having a predetermined concentration, and a polishing liquid pipe for delivering the polishing liquid from the supply tank to a polishing liquid supply nozzle in the polishing unit. The polishing liquid supply apparatus further includes an additive tank for storing an additive having a predetermined concentration, and an additive supply pipe for adding the additive supplied from the additive tank to the polishing liquid stored in the supply tank or to the polishing liquid in a polishing liquid passage including the polishing liquid pipe.(see abstract)

Claims 1-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Kawashima (US6358125).

Concerning the pump, Kawashima teaches the following:

An additive supply pipe 220 is connected to the bottom of the concentration adjustment tank 203. The additive supply pipe 220 serves to deliver the additive to a polishing liquid supply system with an additive supply pump 219. The additive supply pump 219 may comprise a diaphragm pump, a plunger pump, a tubing pump, or the like for supplying the additive at a controlled constant rate. It is desirable that the additive supply pump 219 comprises a plunger pump for supplying the additive at a highly stable

rate. The polishing liquid supply system refers to a system downstream of the loop which comprises the supply tank 18, the supply pump 34, and the supply pipe 36.(see col. 6, lines 13-25)

Concerning the concentration detector and the ultrasonic concentration detector, Kawashima teaches the following:

The polishing liquid pipe 46 has a flow rate sensor 303 and a concentration sensor 305 and the additive supply pipe 222 has a flow rate sensor 304 for confirming whether the polishing liquid supply system is supplied with a predetermined quantity of the additive. Although the additive supply pipe 222 may have an additive concentration sensor, since it is usually difficult to measure an additive concentration from the additive alone, the typical property of the polishing liquid is detected by the concentration sensor 305 after the additive is added to the polishing liquid. The concentration sensor 305 comprises an ultrasonic concentration sensor, for example, and each of the flow rate sensors 303, 304 comprises an ultrasonic flow rate sensor, for example.(see col. 6, lines 42-54)

Concerning the controller, Kawashima teaches the following:

a controller for controlling the additive concentration adjusting device based on an output from said sensor.(see claim 6)

Concerning the oxidizing agent, Kawashima teaches the following:

The polishing liquid contains an additive such as an oxidizing agent for modifying or reforming the polished surface of the semiconductor wafer.

Specifically, an oxidizing agent such as H.sub.2 O.sub.2 (hydrogen peroxide) is added for the purpose of oxidizing a metal film of copper or tungsten that has been deposited on the semiconductor wafer. It has been customary to add the additive when the polishing liquid is produced. Thus, in the case where the additive, like oxidizing agent, added to the polishing liquid is chemically unstable, the properties of the polishing liquid tend to be changed when the polishing liquid with the additive is held in stock for a long period of time, with the result that the polishing capability of the polishing liquid becomes unstable.(see col. 2, lines 20-34)

Concerning the slurry, Kawashima teaches the following:

A polishing liquid supply apparatus supplies a polishing liquid to a polishing unit. The polishing liquid supply apparatus includes a supply tank for storing a polishing liquid having a predetermined concentration, and a polishing liquid pipe for delivering the polishing liquid from the supply tank to a polishing liquid supply nozzle in the polishing unit. The polishing liquid supply apparatus further includes an additive tank for storing an additive having a predetermined concentration, and an additive supply pipe for adding the additive supplied from the additive tank to the polishing liquid stored in the supply tank or to the polishing liquid in a polishing liquid passage including the polishing liquid pipe.(see absract)

Claims 1-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Hiraoka (US6874929).

Concerning the preparation tank, Hiraoka teaches the following:

> The structure of the first mixing tank 12a will be described referring to FIG. 4. Since the first mixing tank 12a and the second mixing tank 12b are preferably of the same structure, description of the second mixing tank 12b is omitted.(see col. 6, lines 50-55)

Concerning the pump, Hiraoka teaches the following:

> A first circulating pipe 62a and a second circulating pipe 62b are connected respectively to the first and second stock solution tanks 13 and 14. The circulating pipes 62a and 62b are provided with a third pump 63a and a fourth pump 63b, relief valves 64a and 64b and flow control valves 65a and 65b, respectively. The third and fourth pumps 63a and 63b are provided to circulate the stock solutions 15 and 16 through the first and second circulating pipes 62a and 62b, respectively, to prevent occurrence of precipitation in the stock solutions 15 and 16.(see col. 18, lines 5-15)

Concerning the controller, Hiraoka teaches the following:

> The present invention further provides a chemical supply apparatus for preparing a mixture by mixing a plurality of stock chemicals and supplying the mixture to at least one processing unit, the apparatus comprising: a first mixing tank and a second mixing tank, each having a capacity corresponding to an amount of the mixture required by the processing unit,

each mixing tank for preparing a batch of the mixture by mixing predetermined amounts of the stock chemicals and water; a main circulating pipe commonly connected to the each of the first and second mixing tanks and the processing unit for supplying the mixture in the mixing tanks to the processing unit; a first circulating pipe and a second circulating pipe connected to the first and second mixing tanks, respectively, to circulate the mixture in each one of the mixing tanks; a liquid level sensor provided with each of the mixing tanks for respectively measuring the amount of liquid disposed in each of the mixing tanks; first and second selector valves respectively connected between each of the mixing tanks, the circulating pipes, and the main circulating pipe, for selectively connecting the mixing tanks to one of the main circulating pipe and its respective circulating pipe; and a control unit for controlling the selector valves based on the detected liquid levels in the mixing tanks, the control unit connecting one of the mixing tanks to the main circulating pipe and the other mixing tank to its circulating pipe, wherein when the liquid level of the mixture in the one tank reaches a first predetermined low level, the control unit begins to prepare a new batch of the mixture in the other mixing tank.(see cols. 2-3)

Concerning the ultrasonic concentration detector, Hiraoka teaches the following:

Further, the first and second mixing tanks 12a and 12b are provided with level sensors 40a and 40b respectively. The level sensors 40a and 40b are

> attached to the bottoms of the first and second mixing tanks 12a and 12b to transmit ultrasonic waves to the slurries 17 in the tanks 12a and 13b, respectively. The level sensors 40a and 40b measure the amounts of abrasive grains deposited in the first and second mixing tanks 12a and 12b by measuring the difference in the intensity of the ultrasonic waves reflected from the inside of the mixing tanks 12a and 12b.(see col. 10, lines 25-49)

Concerning the oxidizing agent, Hiraoka teaches the following:

> The first stock solution tank 13 stores a first stock solution 15, preferably an abrasive grain such as a suspension of alumina. The second stock solution tank 14 stores therein a second stock solution 16, which is preferably an oxidizing agent, such as a solution of ferric nitrate. The alumina suspension and the ferric nitrate solution are used to prepare a metal slurry for polishing metallic layers formed on wafers, such as of aluminum. The slurry feeder 11 prepares slurry 17 by diluting and mixing the stock solutions 15 and 16, in predetermined amounts, in the first and second mixing tanks 12a and 12b. The slurry feeder 11 then supplies the slurries 17 to CMP units 18a and 18b.(see col. 4, lines 27-38)

Concerning the slurry, Hiraoka teaches the following:

> Conventional chemical supplying apparatus, for example, a slurry feeder which supplies a slurry to a chemical machine-polishing unit (hereinafter simply referred to as CMP unit) includes a first tank in which stock solutions are diluted and mixed to prepare the slurry and a second tank in

which the slurry is stored. The slurry feeder first draws stock-solution (e.g., a suspension of alumina serving as abrasive grains and a solution of ferric nitrate serving as an oxidizing agent) from stock solution tanks and supplies the stock solutions to the first tank. The slurry feeder also supplies pure water to the first tank to carry out diluting and mixing treatment, thereby forming a slurry having a predetermined concentration. The slurry feeder then feeds the slurry to the second tank to store the slurry therein. The slurry feeder supplies the slurry to CMP units employing various kinds of pumps based on commands from the CMP units during polishing treatment. When the amount of slurry in the second tank decreases to a preset level, the slurry feeder prepares a new batch of slurry to supplement the slurry in the second tank, ensuring storage of a sufficient amount of slurry in the second tank.(see col. 1, lines 29-50)

Claims 1-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Hiraoka, Naoki (US20050142883).

Concerning the preparation tank, Hiraoka, Naoki teaches the following:

[0045] The structure of the first mixing tank 12a will be described referring to FIG. 4. Since the first mixing tank 12a and the second mixing tank 12b are preferably of the same structure, description of the second mixing tank 12b is omitted.

Concerning the pump, Hiraoka, Naoki teaches the following:

[0131] A first circulating pipe 62a and a second circulating pipe 62b are connected respectively to the first and second stock solution tanks 13 and 14. The circulating pipes 62a and 62b are provided with a third pump 63a and a fourth pump 63b, relief valves 64a and 64b and flow control valves 65a and 65b, respectively. The third and fourth pumps 63a and 63b are provided to circulate the stock solutions 15 and 16 through the first and second circulating pipes 62a and 62b, respectively, to prevent occurrence of precipitation in the stock solutions 15 and 16.

Concerning the controller, Hiraoka, Naoki teaches the following:

[0009] The present invention further provides a chemical supply apparatus for preparing a mixture by mixing a plurality of stock chemicals and supplying the mixture to at least one processing unit, the apparatus comprising: a first mixing tank and a second mixing tank, each having a capacity corresponding to an amount of the mixture required by the processing unit, each mixing tank for preparing a batch of the mixture by mixing predetermined amounts of the stock chemicals and water; a main circulating pipe commonly connected to the each of the first and second mixing tanks and the processing unit for supplying the mixture in the mixing tanks to the processing unit; a first circulating pipe and a second circulating pipe connected to the first and second mixing tanks, respectively, to circulate the mixture in each one of the mixing tanks; a liquid level sensor provided with each of the mixing tanks for

respectively measuring the amount of liquid disposed in each of the mixing tanks; first and second selector valves respectively connected between each of the mixing tanks, the circulating pipes, and the main circulating pipe, for selectively connecting the mixing tanks to one of the main circulating pipe and its respective circulating pipe; and a control unit for controlling the selector valves based on the detected liquid levels in the mixing tanks, the control unit connecting one of the mixing tanks to the main circulating pipe and the other mixing tank to its circulating pipe, wherein when the liquid level of the mixture in the one tank reaches a first predetermined low level, the control unit begins to prepare a new batch of the mixture in the other mixing tank.

Concerning the ultrasonic concentration detector, Hiraoka, Naoki teaches the following:

[0063] Further, the first and second mixing tanks 12a and 12b are provided with level sensors 40a and 40b respectively. The level sensors 40a and 40b are attached to the bottoms of the first and second mixing tanks 12a and 12b to transmit ultrasonic waves to the slurries 17 in the tanks 12a and 13b, respectively. The level sensors 40a and 40b measure the amounts of abrasive grains deposited in the first and second mixing tanks 12a and 12b by measuring the difference in the intensity of the ultrasonic waves reflected from the inside of the mixing tanks 12a and 12b.

Concerning the oxidizing agent, Hiraoka, Naoki teaches the following:

[0027] The first stock solution tank 13 stores a first stock solution 15,

preferably an abrasive grain such as a suspension of alumina. The second stock solution tank 14 stores therein a second stock solution 16, which is preferably an oxidizing agent, such as a solution of ferric nitrate. The alumina suspension and the ferric nitrate solution are used to prepare a metal slurry for polishing metallic layers formed on wafers, such as of aluminum. The slurry feeder 11 prepares slurry 17 by diluting and mixing the stock solutions 15 and 16, in predetermined amounts, in the first and second mixing tanks 12a and 12b. The slurry feeder 11 then supplies the slurries 17 to CMP units 18a and 18b.

Concerning the slurry, Hiraoka, Naoki teaches the following:

[0003] Conventional chemical supplying apparatus, for example, a slurry feeder which supplies a slurry to a chemical machine-polishing unit (hereinafter simply referred to as CMP unit) includes a first tank in which stock solutions are diluted and mixed to prepare the slurry and a second tank in which the slurry is stored. The slurry feeder first draws stock solution (e.g., a suspension of alumina serving as abrasive grains and a solution of ferric nitrate serving as an oxidizing agent) from stock solution tanks and supplies the stock solutions to the first tank. The slurry feeder also supplies pure water to the first tank to carry out diluting and mixing treatment, thereby forming a slurry having a predetermined concentration. The slurry feeder then feeds the slurry to the second tank to store the slurry therein. The slurry feeder supplies

the slurry to CMP units employing various kinds of pumps based on commands from the CMP units during polishing treatment. When the amount of slurry in the second tank decreases to a preset level, the slurry feeder prepares a new batch of slurry to supplement the slurry in the second tank, ensuring storage of a sufficient amount of slurry in the second tank.

Claims 1-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Hiraoka, Naoki (US20020186613).

Concerning the preparation tank, Hiraoka, Naoki teaches the following:

[0046] The structure of the first mixing tank 12a will be described referring to FIG. 4. Since the first mixing tank 12a and the second mixing tank 12b are preferably of the same structure, description of the second mixing tank 12b is omitted.

Concerning the pump, Hiraoka, Naoki teaches the following:

[0133] A first circulating pipe 62a and a second circulating pipe 62b are connected respectively to the first and second stock solution tanks 13 and 14. The circulating pipes 62a and 62b are provided with a third pump 63a and a fourth pump 63b, relief valves 64a and 64b and flow control valves 65a and 65b, respectively. The third and fourth pumps 63a and 63b are provided to circulate the stock solutions 15 and 16 through the first and second circulating pipes 62a and 62b, respectively, to prevent

occurrence of precipitation in the stock solutions 15 and 16.

Concerning the controller, Hiraoka, Naoki teaches the following:

13. The chemical supply apparatus of claim 12, further comprising a plurality of control valves for controlling the amount of stock chemicals flowing through the connecting pipes, wherein the control unit controls the control valves to reduce flow rates of the stock chemicals flowing through the connecting pipes when the amount of the mixture prepared in the mixing tank reaches a first predetermined full level. (see claim 13)

Concerning the ultrasonic concentration detector, Hiraoka, Naoki teaches the following:

[0065] Further, the first and second mixing tanks 12a and 12b are provided with level sensors 40a and 40b respectively. The level sensors 40a and 40b are attached to the bottoms of the first and second mixing tanks 12a and 12b to transmit ultrasonic waves to the slurries 17 in the tanks 12a and 13b, respectively. The level sensors 40a and 40b measure the amounts of abrasive grains deposited in the first and second mixing tanks 12a and 12b by measuring the difference in the intensity of the ultrasonic waves reflected from the inside of the mixing tanks 12a and 12b.

Concerning the oxidizing agent, Hiraoka, Naoki teaches the following:

19. The chemical supply apparatus of claim 3, wherein the stock chemicals include two stock chemicals, one including polishing abrasive grains and the other being an oxidizing agent.(see claim 19)

Concerning the slurry, Hiraoka, Naoki teaches the following:

[0003] Conventional chemical supplying apparatus, for example, a slurry feeder which supplies a slurry to a chemical machine-polishing unit (hereinafter simply referred to as CMP unit) includes a first tank in which stock solutions are diluted and mixed to prepare the slurry and a second tank in which the slurry is stored. The slurry feeder first draws stock solution (e.g., a suspension of alumina serving as abrasive grains and a solution of ferric nitrate serving as an oxidizing agent) from stock solution tanks and supplies the stock solutions to the first tank. The slurry feeder also supplies pure water to the first tank to carry out diluting and mixing treatment, thereby forming a slurry having a predetermined concentration. The slurry feeder then feeds the slurry to the second tank to store the slurry therein. The slurry feeder supplies the slurry to CMP units employing various kinds of pumps based on commands from the CMP units during polishing treatment. When the amount of slurry in the second tank decreases to a preset level, the slurry feeder prepares a new batch of slurry to supplement the slurry in the second tank, ensuring storage of a sufficient amount of slurry in the second tank.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregory E. Webb whose telephone number is 571-272-1325. The examiner can normally be reached on 9:00-17:30 (m-f).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra Gupta can be reached on 571-272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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